



# Research and Development

LONG-TERM PERFORMANCE OF  
EPA-CERTIFIED PHASE 2 WOODSTOVES,  
KLAMATH FALLS AND PORTLAND  
OREGON: 1998-1999

## Prepared for

Office of Air Quality Planning and Standards

## Prepared by

National Risk Management  
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## FOREWORD

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**Long - Term Performance of EPA-Certified Phase 2 Woodstoves,  
Klamath Falls and Portland, Oregon: 1998/1999**

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## Executive Summary

Woodstoves have been identified as a major source of particulate and polycyclic organic matter (POM) emissions. For this reason, new source performance standards (NSPS) were promulgated for wood heaters. Wood heaters sold after July 1, 1992, had to be certified for low emissions, meet the most stringent requirements of the NSPS, and are referred to as Phase 2 certified. Of concern has been the fact that laboratory and field studies have shown that certified wood heaters can physically degrade with use and their air emissions commensurately increase.

The objective of this study was to evaluate the condition and air emissions from old phase 2 certified wood heaters installed in homes and used regularly for home heating since the 1992/1993 heating season or earlier. Study stoves were inspected and their conditions were documented. Particulate and POM samples were collected from the stoves during normal in-home use with an automated woodstove emission sampler (AWES). The AWES was developed specifically for the in-home collection of air emission samples from residential wood burning appliances and data developed from its use have previously been used to calculate particulate emission factors published in AP-42. In addition to data obtained from the use of the AWES, ancillary information such as the history of each woodstove, installation characteristics and cordwood properties were compiled for the study.

Sixteen stoves were evaluated in the study, eight in Klamath Falls, Oregon, and eight in Portland, Oregon. All 16 stoves showed the effects of use. However, only six were degraded to the point that it was speculated that their condition would significantly affect air emissions.

An extensive data base from 43 week-long test runs was developed. No direct statistical correlation between emissions and wood moisture, burn rate or the conditions of the stoves could be made due to the number of variables associated with the real-world in-home use of woodstoves. However, the particulate emissions for stoves in homes in Portland were on the average higher than for stoves in homes in Klamath Falls. This result is consistent with the average higher fuel moisture content and burn rate characteristic of the Portland portion of the study as compared to the Klamath Falls portion.

The particulate emission factors of the certified Phase 2 stoves evaluated in this study appear to have increased with use, but on the average, after about seven years they still have lower emissions than uncertified conventional stoves. In addition, it was clear from the results that the emission rates for Phase 2 stove models reported as part of the NSPS certification process do not represent emission levels of same stove models in homes after extended use.

The data demonstrate that particulate emissions can not be used as a surrogate measurement for POM emissions of woodstoves. Further, POM emission factors, as based on the 7-PAH and 16-PAH values, determined from the in-home use of woodstoves in this study were lower than the POM emission factors previously published in AP-42. This observation is significant because the AP-42 emission factors are the basis for the national emission inventory of POM for which residential wood combustion was identified as the single largest source.

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